

REMARKS

Claims 1-3, 5-46 and 48-85 have been examined in this application. Claims 4 and 47 were previously cancelled.

Claims 74, 82, 83 and 84 are rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. **Claims 1-3, 5, 7, 8, 11, 12, 21-26, 29-31, 34, 35, 42-44, 48-54, 56-58, 61-64, 68, 73 and 82-85** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279). **Claims 6, 27 and 55** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279) and in further view of Huang (U.S. Patent Application Pub 2004/0213333). **Claims 9, 10, 59 and 60** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279) and in further view of Lis (U.S. Patent Application Pub 2004/0037432). **Claims 13, 14, 32, 33 and 65-67** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Bedini (U.S. Patent 4,555,795). **Claims 15-20 and 36-41** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279) and in further view of Terui (U.S. Patent 5,903,871). **Claims 45 and 71** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Groves Jr. (U.S. Patent 6,593,807) and in further view of Izandpanah (U.S. Patent 6,735,398). **Claims 46 and 72** are rejected under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279) and in further view of Pennock (U.S. Patent 6,573,850).

Claim 74 would be allowable if rewritten or amended to overcome the rejection under 35 USC 112, second paragraph. An appropriate amendment has been made.

Claims 75-81 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Statement of Substance of Interview held on 7 October 2005

Applicants appreciate Examiner Flanders' preparation for the interview and thorough discussion of the technology. We especially appreciate the extensive effort that he described having undertaken to find any relevant art.

In advance of the interview, we submitted a proposed agenda, the substance of which was:

"The spirit of this interview is to advance the case towards allowance. We recently received an office action which indicated that claim 74 would be allowable if amended to overcome section 112 rejections, which can readily be done.

Issues for the interview include:

1. Negotiating an amendment to method claim 82, consistent with the allowable limitations and device claim 74.
2. Eliciting from the Examiner a diagram on the white board or a piece of paper depicting how the Examiner envisions combining the Ruha '087 and Oprescu '279 references, on which he relies for most the section 103 rejections. We would like to identify the glue logic required and the changes to the Ruha '087 reference that are implied by the combination.?

During the interview, we began with a technology tutorial and turned to the topics identified in the agenda. The technology tutorial covered the disclosure, and the Ruha and Oprescu references. The technology disclosed is unusual because the normal application of a pulse width modulator is applying a sawtooth filter to an analog signal. We mentioned the approach that well-known audio component manufacturer Bang & Olufsen describes in their technical papers, some of which had been submitted to the Examiner in an information disclosure statement.

We particularly pointed out that the filter in Oprescu is not the same type or a variation on the type of filter disclosed. There is no technical reason to believe that applying Oprescu's filter would produce a correction signal or reduce distortion caused by generating a pulse width modulated signal from an oversampled digital signal. During the interview, the Examiner did not offer any technical reason to believe that the filter would work.

We also pointed out that Ruha's filter is a directional filter, not in any way matched to the input signal. Ruha's filter, described in col. 5, outputs a one-bit signal

indicating the sign of a difference. It is not matched in format to the input signal or combined with the input signal.

The motivation to substitute Opreschu's unproven filter for Ruha's one-bit directional filter signal is entirely missing.

We discussed amendment of claim 82, to be inclusive of both feed back and feed forward, leaving it to dependent claim 83 to focus on feed back.

We also discussed the lack of relevant art, the fact that the Examiner did not find any references applying a digital filter in the manners disclosed and claimed, despite extensive searches.

No agreements were reached, as the Examiner lacked negotiation or signing authority.

Rejection Under 35 U.S.C. 112, second paragraph of Claims 74, 82, 83 and 84

The Examiner rejects **claims 74, 82, 83 and 84** under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 74 and 82 have been amended. Amendment of claim 82 provides the antecedent basis for claims 83-84. Applicant respectfully submits that claims 74, 82, 83 and 84 should be allowable over the Section 112 rejection.

Rejection Under 35 U.S.C. § 102(a) of Claims 82-85

The Examiner rejects **claims 82-85** under 35 U.S.C. § 102(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Oprescu (U.S. Patent 6,208,279). We begin with these claims, because claim 82 as amended should now be allowable for the same reasons as claim 74, which the Examiner has allowed.

Claim 82 includes the limitations:

A method of preprocessing a pulse encoded digital signal for amplification by a digital amplifier, the method including:

oversampling a wide-bit input signal to produce a second signal that has lower bits precision than the input signal;

converting the second signal into a pulse width modulated signal, whereby undesirable distortion is introduced;

digitally filtering the pulse width modulated signal to correct at least part of the undesirable distortion and produce a correction signal; and

producing a corrected pulse width modulated signal using the correction signal combined with a version of the input signal.

The added text addresses both feed back and feed forward, allowing that a version of the input signal could be combined with the correction signal at a differencing element (see claim 83) in a feedback configuration, or with a delayed input signal in a feed forward configuration. This builds on the Examiner's suggestion during our interview.

Applicant respectfully submits that claims 82-85 should be allowable over Ruha in view of Oprescu. With these amendments, claims 74-85 should be allowed.

Rejection Under 35 U.S.C. § 103(a) of Claims 1-3, 5, 7, 8, 11, 12, 21-26, 29-31, 34, 35, 42-44, 48-54, 56-58, 61-64, 68, and 73

The Examiner rejects claims 1-3, 5, 7, 8, 11, 12, 21-26, 29-31, 34, 35, 42-44, 48-54, 56-58, 61-64, 68, and 73 under 35 U.S.C. § 102(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Oprescu (U.S. Patent 6,208,279).

The Office Action says that the Examiner was persuaded by our prior argument, that Ruha treats the output of the pulse width modulator as an ideal reference signal, without recognizing distortion in the PWM output or attempting to correct distortion in that output. From Ruha col. 5, lines 35-44:

In greater detail, the filter 16A of FIG. 6B operates to measure the short-term averaged difference between the reference PWM signal and the actual output signal of the switching stage 14. The ***reference PWM signal output from the PWM modulator 12 is assumed to be ideal***, and is further assumed to be generated ***from a clean and well-regulated power supply***. This latter assumption is feasible to realize, as the actual power taken from the power supply that powers the PWM modulator 12 is relatively low.

The result that Ruha teaches, using the PWM output as an ideal reference, is to match the output of the power stage to the PWM output, at col. 6, lines 58-62:

The ***overall result*** of this feedback/correction mechanism is an attempt to ***adjust the pulse width*** (area) of the PWM signal ***output from the power stage 15*** to be ***equal to the area of the ideal PWM signal output from the PWM block 12***.

This argument undercuts any explicit or implied motivation from Ruha to correct the PWM signal output for distortion caused by pulse width modulation.

Claims 1, 23 and 24

Independent claims 1, 23 and 24 include limitations such as:

a digital filter configured to receive an output of said pulse width modulator, wherein said output comprises a distortion, and wherein said digital filter samples said output at said clock rate to suppress said distortion

These limitations are not found in Ruha in view of Opreschu, as the Examiner has not found a filter as described in either reference. Ruha's filter 16A in FIG. 6B is labeled an "analog filter" such as an "RC Network". Opreschu's filter 30 is a FIR filter, described in column 4 as functioning to reduce the signal frequency and produce multi-bit digital output words R(l) from "a sequence of one-bit digital words". "Thus, digital filter 30 may be viewed as a pulse-density-modulation (short digital word) to pulse-code-modulation (long digital word) converter." Col. 4, lines 40-43.

The Examiner acknowledges that Ruha does not disclose a digital filter. The Examiner's discussion of Opreschu (OA 4) says nothing about the nature of Opreschu's filter that would read on these independent claims. No technical reason is given to believe that "a pulse-density-modulation (short digital word) to pulse-code-modulation (long digital word) converter" would have any application to a pulse width modulated signal.

No motivation is apparent to combine Opreschu's converter filter with Ruha's circuit. There is no motivation cited from either reference. The supposed motivation, "to ensure that the output of the PWM is an ideal signal" contradicts Ruha and is not satisfied in any way by the converter filter. Force fitting Opreschu's converter filter into Ruha's circuit would almost certainly break it; nothing good would be expected.

Therefore, independent claims 1, 23 and 24 should be allowable over Ruha in view of Oprescu.

Claim 48

Independent claim 48 includes the limitations:

An integrated circuit chip configured to receive a pulse code modulated digital signal and to generate a pulse width modulated digital output signal, wherein said output signal has a distortion, and wherein said distortion is suppressed by a digital filter that operates at at least a clock rate of said pulse width modulated digital signal.

These limitations are not found in Ruha in view of Oprescu. As the Examiner already has acknowledged being persuaded, Ruha treats the output of the pulse width modulator as an ideal reference signal, without recognizing distortion in the PWM output

or attempting to correct distortion in that output. Col. 5, lines 35-44.

The Examiner mistakenly asserts that Ruha further discloses “an integrated circuit chip configured to receive a pulse code modulated digital signal and to generate a pulse width modulated digital output signal, wherein said output has a distortion, and wherein said distortion is suppressed by a digital filter that operates at at least a clock rate of said pulse width modulated digital signal.” (OA 9) As the Examiner has acknowledged, Ruha presents an analog filter, not a digital filter of any type. The Examiner’s assertion is simply mistaken.

Therefore, claim 48 should be allowable over Ruha.

Claims 49 and 68

Independent claims 49 and 68 include the limitations:

(49) modulating said second pulse code modulated signal into a third signal comprising a plurality of pulses in time having a clock rate; and

filtering in a digital domain said plurality of pulses in time to suppress a distortion in said third signal

(69) means for modulating said second pulse code modulated signal into a third signal comprising a plurality of pulses in time having a clock rate; and

means for filtering in a digital domain said plurality of pulses in time to suppress a distortion in said third signal

These limitations are not found in Ruha.

Addressing these claims, the Examiner repeats, essentially verbatim, the argument made against claim 1, above. Repeating our response, the Examiner has not found in either reference a filter as described. No technical reason is given to believe that Opreschu’s “pulse-density-modulation (short digital word) to pulse-code-modulation (long digital word) converter” would have any application to a pulse width modulated signal. No motivation is apparent to add combine Opreschu’s converter filter with Ruha’s circuit. There is not motivation cited from either reference. The supposed motivation, “to ensure that the output of the PWM is an ideal signal” is contradicted by Ruha and not satisfied in any way by the converter filter. Force fitting Opreschu’s converter filter into Ruha’s circuit would almost certainly break it; nothing good would be expected.

Therefore, claims 49 and 68 should be allowable over Ruha.

Dependent Claims in this Grouping

The remaining dependent claims should be allowable for additional reasons, not repeated here, but found in our first response to office action dated June 13, 2005

Applicant respectfully submits that claims 1-3, 5, 7, 8, 11, 12, 21-26, 29-31, 34, 35, 42-44, 48-54, 56-58, 61-64, 68, and 73 should be allowable over Ruha in view of Oprescu.

Rejection Under 35 U.S.C. § 103(a) of Claims 6, 27 and 55; 9, 10, 59 and 60; 13, 14, 32, 33 and 65-67; 15-20 and 36-41; 45 and 71; and 46 and 72, Based on Various References

The Examiner rejects **claims 6, 27 and 55** under 35 U.S.C. § 103(a) as unpatentable over Ruha (U.S. Patent 6,566,087) in view of Operscu (U.S. Patent 6,208,279) and in further view of Huang (U.S. Patent Application Pub 2004/0213333).

The Examiner rejects **claims 9, 10, 59 and 60** under 35 U.S.C. 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279) and in further view of Lis (U.S. Patent Application Pub 2004/0037432).

The Examiner rejects **claims 13, 14, 32, 33 and 65-67** under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Bedini (U.S. Patent 4,555,795).

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The Examiner rejects **claims 45 and 71** under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Groves Jr. (U.S. Patent 6,593,807) and in further view of Izandpanah (U.S. Patent 6,735,398).

The Examiner rejects **claims 46 and 72** under 35 USC 103(a) as being unpatentable over Ruha (U.S. Patent 6,466, 087) in view of Oprescu (U.S. Patent 6,208,279) and in further view of Pennock (U.S. Patent 6,573,850).

All of these claims are dependent claims that should be allowable for at least the same reasons as the claims from which they depend. They also should be allowable for

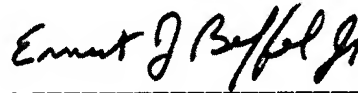
the reasons stated in our response to the first office action, which are referenced but not repeated here.

CONCLUSION

Applicants respectfully submit that the pending claims are now in condition for allowance and thereby solicit acceptance of the claims, in light of these amendments.

If the Examiner has any questions with regard to this application, the undersigned can ordinarily be reached at his office at (650) 712-0340 from 8:30 to 5:30 PST, Monday through Friday, and can be reached at his cell phone at (415) 902-6112 most other times.

Respectfully submitted,



Dated: 06 December 2005

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